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ORCHARD COVER CROPS

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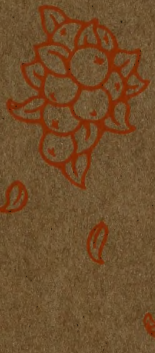

ORCHARD COVER CROPS

a paper by

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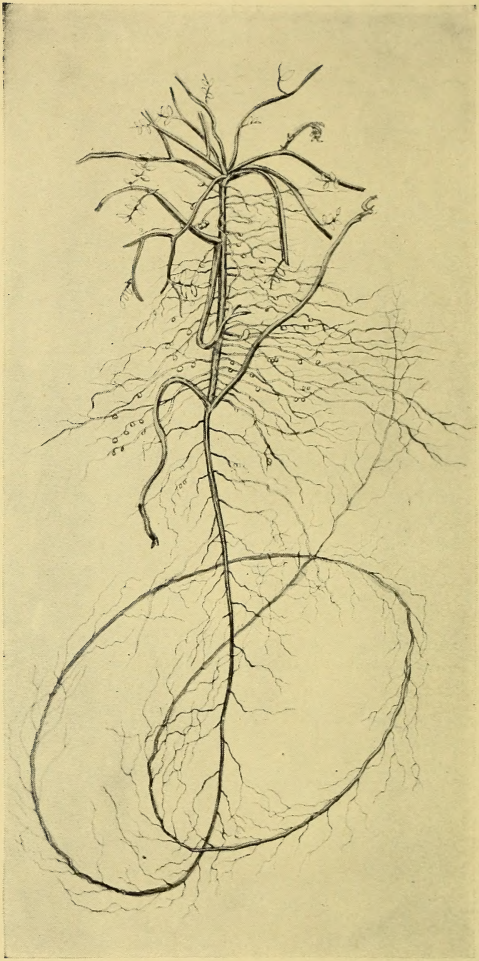

Fig. 1. Hairy Vetch root Note the long tap root, and the nitrogen gathered nodules on the lateral rootlets

Orchard Cover Crops

A COVER CROP system is not only highly essential to the present success of the orchard, but to its future success—the lack of it may explain failure.

The more we learn of cover crops, the more we appreciate their fundamental importance. We have observed cover crops as used in the peach orchards of Georgia and other southern states, of the Lake Shore country in New York, Pennsylvania, of Michigan, Ohio, Maryland, Delaware, etc. We have carefully observed cover crops throughout our own state—and too often the lack of them in the Pacific Coast country and the Northwest.

It is necessary that fruit growers care for their orchards as they care for other farm crops. An orchard takes the fertility from the land, as do wheat and corn, though not to the same extent. Few farmers can name a crop that will give a greater income with less risk and less capital than an orchard; however, they must have a little love, or at least respect, for their trees, and look after them carefully.

It is a common saying among orchardists that we do not get bumper crops as in the old days when this was a virgin country. To repeat such crops, one absolute necessity is to put the soil in as near the fertile condition it was following the removal of the forests. The mineral elements of the soil remain, but the humus has been "burned out." After this humus is gone it is harder for the plants to use the minerals.

There are two ways to restore vanishing fertility. One method is by applying fertilizers The so-called "complete" commercial fertilize. contains three elements, nitrogen, potassium and phosphorus, which are most commonly lacking

in land that has ceased to produce. Commercial fertilizers rightly used are profitable, but are expensive. Barnyard manure is a cheaper fertilizer but more bulky. It contains a fair percentage of the three elements. Both commercial fertilizers and barnyard manure are all right in their place, but the supply is limited. Many growers are gradually reducing the ability of their orchards to bear. It is a question of vital importance to the fruit grower. Cover crops solve the problem. They are economical and consistent with the best methods of farm management. Clover, cow peas and other legumes indirectly take nitrogen from the air by action of bacteria living in the root nodules. See fig. 1, page 2, and change it to a form that can be used by plants.

The elements of the soil can be classed under two heads: First, Mineral Elements—which are the residue of decomposed rock—pure clay is a good example; it may not have occurred to you in just this light, but practically all earthy soil came either directly or indirectly from the original stone. The soil usually contains the same minerals as the underlying rocks, except a large part of the more soluble material has been washed out.

Second, Humus—which is partially decayed organic matter—leaf mold, grass, weed, etc., that have lost their original form but in which the process of decay is incomplete. Peat and muck are good examples of soils which are practically all humus. Between the two extremes of pure clay and muck, there are almost an infinite number of loamy and sandy soils. The earthy portion of the soil contains practically all minerals necessary for plant growth. In some cases potash and phosphate may be lacking, but these are infrequent. On the other hand, they

are often in an unavailable form, that is, the soil may contain a large amount of each, but it is insoluble and the plants can not make use of it. Clay lands are usually rich in potash, while limestone lands nearly always contain sufficient phosphate.

Humus supplies nitrogen to the soil. Most of the nitrogen is locked up in the humus which breaks down gradually, thus supplying the plants with food and preventing excessive waste. The soil has been called "Nature's Work-shop and Chemical Laboratory." It is a laboratory and the simplest processes that go on there are far more complex than the most intricate experiments of our scientific investigators. Nitrogen in plants is converted during the complex process of decay into nitrites which are then ready to be used by plants. Organic matter, when decaying, forms carbonic acid in the soil, and although this is a very weak acid, it is able to dissolve much of the potash and phosphate which were formerly insoluble. Thus the three elements commonly sold in commercial fertilizer are furnished for orchard growth by humus. It liberates the potash and phosphate already in the soil and supplies nitrogen.

Humus is beneficial to the soil in many ways. It makes land more porous, enabling it to hold water like a sponge. It makes stiff clay soil of lighter tilth by separating and loosening the soil particles, thus making cultivation easier and more effective.

Cultivation is something more than an efficient method of destroying weeds. It helps to get rid of surplus water—yet if properly done, retains all beneficial moisture. It aerates the soil, letting in the air and warmth, thus aiding the many chemical processes in the soil to

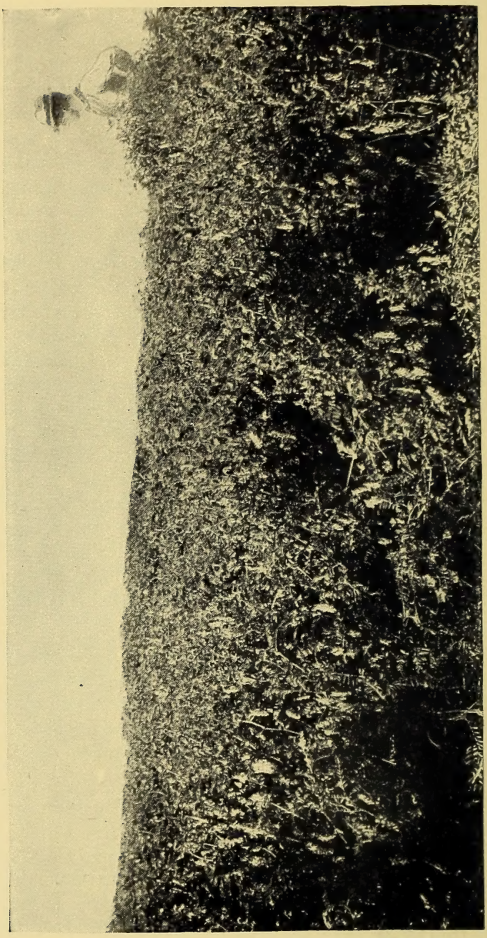

Fig 2. Vetch in the Ozarks Note dense prostrate growth.

greater activity. There is this difference between cultivation and cover crops: *Cultivation liberates plant food already in the soil. Cover Crops also do this and add more to the organic store* at the same time preventing loss of available plant material which would otherwise have leached away. Both are invaluable in their places.

Humus is partially decomposed vegetable matter—not completely decayed. When vegetable matter forms humus, or humus breaks down to form still simpler compounds, heat is liberated. Whether a pile of leaves is burned or allowed to rot, the same amount of heat is eventually given off. Thus, decaying organic matter in the soil makes it warmer and drier in the spring, and growth will start more readily and be faster throughout the season. Humus makes the soil darker, and by test it has been shown that dark soil is warmer than the same soil under like conditions but lighter in color. Dark soil also holds the heat longer.

When a country is in a wild state humus is supplied by dead leaves, grass and other vegetation, most of which falls and rots where it grew, but with modern methods of plowing and clean cultivation, we "burn out" the humus and at the same time do away with the source of supply. We may supply this deficiency by applying barnyard manure and commercial fertilizer, and by using cover crops. (We might add that millions of dollars' worth of fertilizer is lost by the American people through careless handling of manure. It should never be exposed to sun and weather). Cover crops are especially adapted to the best cultural methods in orchards. The ideal cultivation, we believe, is intensive *clean culture from early spring to June or July, depending on the season; then seed to the cover*

crop which seems best adapted to your particular orchard.

Cover crops may be divided into two classes, those taking free nitrogen from the air (clover, cow peas, etc.), and those using only the nitrogen already in the soil. Rye and oats are good examples of the latter, which are used as catch crops where no more nitrogen is desired. They should be used in pear orchards which are inclined to make too rapid growth.

"Catch crops" are necessary because bacteria working in the soil, especially in warm weather, are continually liberating food in the form of nitrates and minerals such as potash and phosphate are also continually changing to soluble form. The nitrates, unless used immediately, are liable to be lost by leaching. Some of the more or less soluble minerals may be lost by washing away in the drainage water; their loss, however, is not so great as that of nitrogen. The growing orchard utilizes these materials during the first part of the season, when growth is most rapid, but later, when growth slackens, a cover crop of some sort is necessary to use this food and get it in a form that can be carried over until the next season without loss. Such crops as clover, cow peas and vetch are especially good. They not only store up all available nitrogen in the soil, but add more from the air, and in the spring they decay readily. Thus they increase the value of crops and extend the life and productive age of the orchard.

During the past season in company with Mr. Irvine, Editor of the Fruit Grower, I visited the orchard regions of Colorado, Utah, Idaho, Washington, Oregon and Montana. Generally our western friends admitted that they knew very little about cover crops, and felt their need. Their

soil, rich in minerals, is often deficient in humus. This is one of the greatest problems they have to meet and they should give it far more attention.

A cover crop on the ground throughout the winter not only prevents washing, which is so disastrous, but holds the winter snows and lessens the depth of alternate freezing and thawing. Note dense protective mat formed by vetch fig. 2, page 6. It also tends to delay growth in the spring until after the killing frosts. In gathering the fruit in the fall, it makes picking and hauling a cheaper and cleaner job.

The rapid growth induced by cultivation through the first of the season is inclined to make the wood of the new trees soft and tender. To check this growth and mature the wood for winter, the cover crop is practically necessary. Weeds or volunteer grass might be allowed to fulfill the same purpose, but they do not add the same fiber to the soil, and they add absolutely nothing in the way of nitrogen from the air.

There are some forms of mineral plant food in the soil, not available to many cultivated plants. Even under the best conditions they have no power to use them; on the other hand, certain plants used as cover crops can digest these less available foods and after decaying, leave them in a form convenient for weaker plants. The roots of many plants do not thrive in the sub-soil. (The surface layer is merely sub-soil to which humus has been added by growing plants.) This sub-soil is very rich in the necessary elements, as it has not been so washed by rain water. It is the cover crops which send their roots burrowing down into the sub-soil and following old worm holes, they force their way deep into the ground. See vetch roots fig. 3, page 10. Here is much valuable food waiting

Fig. 3. Vetch roots penetrating the heavy clay subsoil 3 ft. 8 in.

to be brought to the surface, which other plants cannot reach. Covercrops not only bring these foods to the surface for use in their leaves and stems, but leaving the roots to decay they improve the sub-soil. Eventually a part of the subsoil is incorporated with the surface soil, or in other words, the surface soil is made deeper by these roots working around in the sub-soil, loosening it up and adding humus.

The most important of cover crops which gather nitrogen from the air are the clovers. See fig. 5, page 16. But it is hardly necessary to mention any of these, except Alsyke, which will thrive on land that is too "sour" or too wet for other clovers. (It should be mixed with other hay when fed to stock.)

While in the West we noticed a few orchards sown in clover, and for partial cultivation they plowed a strip and left a strip. The strip left thus became a seeder for the strip turned under, causing fairly good cultivation.

Cow peas are next in importance regarding which The Fruit Grower says:

"Regarding cover crops for the middle West we agree with you that nothing is better than cow peas, except that lots of orchards are on hills so steep that it will not do to give them cultivation in early spring during the rainy season. We think that very soon we shall have to adopt a plan of cultivating two rows and leaving the next two rows in clover and alternating this treatment." Refer fig.4, pp 12.

The higher elevations and more northern states are not adapted to cow peas, but our plant breeders will doubtless give us hardier varieties suited to these conditions. Clover can be used advantageously, but perhaps it is not the ideal crop for localities where intensive cultivation is practiced.

Hairy Vetch is probably one of the best crops suited to these methods. Intensive, clean culture can be given until mid-summer; vetch

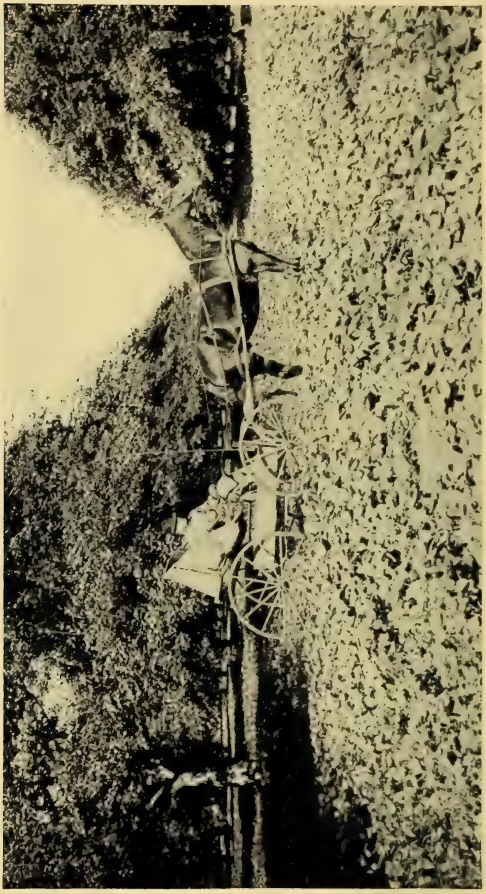

Fig. 4. Cowpeas broadcasted. A New York Orchard.

can then be sown and turned under the following spring. On the subject of hairy vetch, Agrostologist F. Lamson Soribner, in 1895, reported:

"Hairy Vetch sown in autumn will cover the ground and prevent washing during the winter. It is one of the best crops to turn under as green manure. Do not commence to feed hairy vetches until they have begun to bloom. Like most of the bean and clover family they are somewhat diuretic if fed in large quantities before mature. Use caution in feeding until the animals have become accustomed to the change of feed." Refer to fig. 2, page 6.

We have found Canadian peas most desirable in the Genesee Valley of New York. They are also used largely in New Mexico. This is a great crop for fattening lambs and hogs, and here is a suggestion that may be of some value to the West: grow Canadian peas as a crop for fattening sheep and hogs, thereby producing at home a valuable fertilizer—one of the most effective methods of supplying the humus required by western soils.

It is a lamentable fact that such a gold mine is not worked on every farm and orchard. This is true of all localities, but particularly so of the lands like those in the Ozarks which are naturally deficient in humus. (Cow peas make a luxuriant growth in this section.) They have the altitude and nearly everything except the humus; yet through neglectfulness or ignorance the growers do not strive to build up their soil. Many farmers do not seem to know where to get cow peas. Seedsmen do not realize the importance of selling them. As an example, the Ozark country at the present writing, is burned up with a drouth; yet wherever cow peas have been planted they are green and not only making hay but fine pastures, enhancing the value of the land and increasing the fertility.

There are numerous varieties of cow peas adapted to different orchard regions. Occasionally cow peas are followed with a crop of corn. Dur-

ing the last cultivation of the corn, more peas or hairy vetch are sown. Vetch supplies a fine crop for plowing under in the spring and also becomes a profitable pasture crop for hogs when their age and size will permit pasturing without injury to young trees. Peas may be utilized the same way.

The growth of Spanish Peanuts in young orchards is worthy of trial.

Velvet Beans are adapted to conditions further south, where the season is long enough to mature the crop.

Speaking of some personal experiences with cover crops, my son and I have a 200-acre orchard, closely planted, at Rolla, Missouri, in the heart of the Ozark country. There for six years we have made a study of cover crops in a commercial way and have kept in close touch with experimental work at various stations. It is our opinion that to a great extent, the barren condition of orchards is due to impoverished and starved conditions of the soil, naturally deficient in humus. Therefore, our policy has been not to rob the soil, but to build it up by adding to its strength whenever possible and by preventing any loss—always having catch crops ready to take up food not required by the trees.

Capt. J. H. Shawhan, the grand old man of Payette, Idaho, the products of whose orchards attracted attention and blue ribbons at the Council Bluffs Apple Show, and also at the Spokane Apple Show, believes in cover crops, and the adding of humus to the soil. He says when he takes his wondrous crops of fruit from the trees he feels duty bound to give something in return, so in addition to cover crops he makes a generous application of barnyard manure.

The soil in his orchard is so porous and loose that one sinks to the shoe tops.

We believe cover crops the most economical way to supply humus to the soil, especially in orchards. Commercial fertilizers, however, may be used where there is not time enough to build up the land before planting an orchard.

In planting a later addition of 15,000 one-year trees to the Rolla orchards, we applied to the surface-soil around each tree several pounds of commercial "5-8-3", and bone meal (the 5 refers to 5% nitrogen, the 8 to 8% phosphate, and the 3 to 3% potash). Every tree lived and made vigorous growth. Planters of western orchards on land deficient in humus have supplied the deficiency by this method rather than lose a year's time in the cultivation of some crop. We suggest that each tree at the time of planting be given several pounds of ground sheep or other manure, or some commercial brand of fertilizer as may be convenient. (Don't put bulky manure in the tree hole around the roots when planting, as it dries out readily). Abundant humus may then be supplied by the cover crops to follow. This method is also suggested for old land lacking in fertility. The money and time spent in applying the stimulant will prove a profitable investment.

Nitrate of soda is sometimes beneficial in starting growth when backward in the spring; while it stimulates growth, it adds nothing in the way of humus, and it is easily washed from the soil by rain.

Cover crops are necessary for the permanent maintenance of fertility. If we practice clean cultivation, and expect to gather good crops of fruit, we must supply the soil with humus. The cheapest method and one best adapted to orchard cultivation, is to sow cover crops after cultivating the

orchard the first part of the summer and in this way not only maintain the fertility of the land, but actually improve it.

In opening up a new country the virgin land is exploited, the soil is robbed of its fertility and nothing is returned to it. Some of the American farmers have taken less than a generation to "crop their land to death." They had rich farms in the beginning but with each year the yield grows less. Compare this with the land in the old countries of Europe and Asia, some of which were farmed before the birth of Christ. It is a fact that their yield per acre is usually double or more than that of this country. Our supply of new land is nearly exhausted and if we want crops in the future like we have had in the past we can have them only by adding humus to the land—by using green manures—cover crops.

Photographs figs. 1, 2, 3 and 4 by the courtesy of Prof. J. H. Bailey, Cornell University.

Fig. 5. Red Clover, Farmington, Ark.